

67733

On the Causes of Brittleness of Certain Copper Alloys

SOV/126-7-3-41/44

ASSOCIATION: Ural'skiy gosudarstvennyy universitet imeni A.M. Gor'kogo
(Ural State University imeni A.M. Gor'kiy)

SUBMITTED: December 30, 1958

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78.1100

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6689

SOV/126-8-1-8/25

AUTHORS: Arkharov, V. I. and Kralina, A.A.

TITLE: On the Influence of Palladium¹ Additions to Iron on its Hydrogen Permeability¹

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 1, pp 45-52 (USSR)

ABSTRACT: From a consideration of a number of papers (Refs 1-6) it can be assumed that intercrystalline diffusion of hydrogen will proceed to a greater extent in iron containing palladium than in iron without palladium. A similar influence of palladium is possible also in certain iron-base alloys. The authors have investigated diffusion of hydrogen through polycrystalline iron-base alloys containing palladium and compared it with alloys of the same composition but without palladium at identical large and small grain sizes. The following materials were used for experiments: 1) Armco iron, 2) iron containing 0.5% palladium, 3) austenitic iron-chrome-nickel (18% Cr, 7.5% Ni) and 4) an austenitic alloy with the same chromium and nickel content as in 3 but with an addition of 0.5% palladium. The basis of all alloys was Armco iron. After melting and casting, specimens of the above

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alloys were forged into rods of 10 x 10 mm cross-section which were subsequently rolled into plates, 0.25 mm thick (in two stages with inter-annealing at 600°C for 10 hours). The difference in thickness of the plates did not exceed 0.01 mm. Specimens, 12 x 12 mm, were cut out from the plates and were subjected to preliminary annealing at 600°C for 50 hours. Subsequently annealing was carried out in order to obtain fine or coarse grain size. The specimens were annealed in vacuum for 10 hours at various temperatures which were so chosen as to obtain series of specimens of all four alloys with identical grain size; in one series a "fine" grain size (20-25 μ) and in another series a "coarse" grain size (280-290 μ) was obtained. In the austenitic alloys specimens were also obtained with "particularly coarse" grain size (560-580 μ). The annealing temperatures are indicated in Table 1. The condition of the surfaces of the specimens was characterized by the fact that on one side a metallographic section was prepared, whereas the other was allowed to remain in the same condition as after cold rolling and vacuum annealing. ✓

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On the Influence of Palladium Additions to Iron on its Hydrogen Permeability

Experiments for the hydrogen permeability of the specimens were carried out by a special method. A short glass tube was luted to the plate specimen under investigation; thus a small container for an electrolytic bath was obtained. A 1% aqueous solution of sulphuric acid was used as the electrolyte. The specimen forming the bottom of the container was the cathode and a platinum plate (3 x 8 mm) the anode. The latter was placed vertically in the centre of the container, the lower end of the anode being 2 mm above the bottom. During electrolysis the anode was rotated around its vertical axis. Electrolysis was carried out at a current density of 0.22 amps/dm². The lower side of the specimen closely adhered to the orifice of a gas analyser. The diameter of this orifice (10 mm) determined the surface area of the specimen (0.785 cm²) in direct contact with the gas analyser. In this portion of its surface the specimen acted as a diffusion membrane for hydrogen, forming at the cathodes during electrolysis; this diffuses across the specimen into the inner part of the

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On the Influence of Palladium Additions to Iron on its Hydrogen Permeability

gas analyser. The apparatus is shown in Fig 1. It has two chambers, one of which communicates with the space into which the hydrogen gets after diffusing through the specimen; the other is a closed chamber filled with air. In each chamber a calibrated platinum wire spiral of 0.02 mm diameter is placed. These spirals are connected to an electric circuit by a bridge system and they are heated by the current passed through both parallel arms of the system. A zero reading of the galvanometer in series with the bridge corresponds to identical atmosphere composition (air) in both chambers. As soon as some quantity of hydrogen appears in the first chamber the heat emission by the platinum spiral in this chamber is intensified, the temperature of the spiral, and hence its resistance, change, and the galvanometer shows a deflection. The authors used the galvanometer M-21 having a sensitivity of 10^{-9} A. The apparatus was first calibrated according to hydrogen-air mixtures of known composition. In the experiments in which the hydrogen permeability of the alloys investigated was determined, the galvanometer

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readings were registered at even time intervals and a graph for the increase in hydrogen content in the catharometer (i.e. the quantity of hydrogen diffused through the specimen) with electrolysis time was plotted with the help of the graduation curve. The experimental results are shown in Figs 2-6 in the form of graphs showing the dependence of the quantity of hydrogen which had diffused through the specimens on the time of electrolysis. The measured values of the tangent of the angle of inclination of the straight portions of graphs in Figs 2-6 are shown in Table 2. The authors arrived at the following conclusions:

- 1) The hydrogen permeability of iron alloys increases when 0.5% palladium is added.
- 2) The increase in hydrogen permeability caused by the addition of palladium is due mainly to the intercrystalline joints (boundaries).
- 3) The hydrogen permeability in the mass of crystals seems to be due, to a considerable measure, to inter-block joints in the sub-crystal structure.

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SOV/126-8-1-8/25

On the Influence of Palladium Additions to Iron on its Hydrogen Permeability

4) The influence of palladium additions on the hydrogen permeability of iron alloys is due to the internal adsorption of palladium.

There are 6 figures, 2 tables and 7 references, 6 of which are Soviet and 1 English.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals, Ac.Sc., USSR) ✓

SUBMITTED: March 18, 1959

Card 6/6

AUTHOR: Arkharov, V.I.

SOV/126-8-2-7/26

TITLE: Kinetics of the Reaction Diffusion in Systems With Several Intermediate Phases. I. Macroscopic Calculation for a Binary System

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 2, pp 193 - 204 (USSR)

ABSTRACT: The kinetics of reactions involving diffusion are complicated by, among other factors, the fact that one of the components increases partly on account of the adjacent layer. The author first considers the general picture of diffusion in a scaling reaction, where a series of oxides can be formed. He then discusses initial conditions for calculating the rate of growth of scale layers at their boundaries for five possible cases, depending on the relation between the ratio of the amount of metal retained by chemical reaction at the boundary to the quantity of oxygen retained and the ratio of the quantities of components there. This leads to solutions for a multi-layer scale, with values of coefficients capable of determination by observation of scale-layer

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SOV/126-8..2-7/26

Kinetics of the Reaction Diffusion in Systems With Several Intermediate Phases. I. Macroscopic Calculation for a Binary System

growth. By more refined experimentation, making use of macroscopic particles of material not involved in reaction diffusion which is placed in some form on the specimen surface, the metal and oxygen diffusion coefficients can be determined separately from the kinetic curves. Normally, reaction diffusion kinetics ^{are} determined from gain in weight of the specimen and its loss in weight when the scale is removed. The author shows how the "effective" reaction - diffusion coefficients can be found, including the particular case of a double-layer scale.

There are 3 references, 2 of which are Soviet and 1 German.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals of the Ac.Sc.USSR)

SUBMITTED: April 27, 1959

Card 2/2

18. 7530

AUTHORS:

Arkharov, V.I. and Blankova, Ye.B.

66236

SOV/126-8-3-20/33

TITLE:

Investigation of Reaction Diffusion in Binary "Metal-Gas"
Type Systems. I

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3,
pp 452-454 (USSR)

ABSTRACT:

The mechanism of reaction diffusion depends mainly on the type of chemical combination between the reacting elements, structural characteristics of the phases formed and the size ratio of the defluxing particles. The authors suggest that for studying the diffusion mechanism in binary systems the reactions of elements within one period with a single second component, which is then successively changed on the same principle, should be investigated. They give results obtained for binary systems formed by transition elements of the IV period with sulphur. Diffusion annealing was effected at 400 to 1000°C in ampoules evacuated to 10^{-3} - 10^{-4} mm Hg, designed in such a way that the specimen was in contact with sulphur vapour (1 atm approximately) in one part, the sulphur being in another part of the same ampoule. Macro and micro-structures of the scale, its phase

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Investigation of Reaction Diffusion in Binary Systems. I

SOV/126-8-3-20/33
"Metal-Gas" Type

composition, absence or presence of texture were studied and experiments with inert markers of platinum were also carried out. The results for Ti, V, Cr, Mn, Fe, Co and Ni with S are tabulated. The authors conclude that in all these systems the diffusion mechanism is broadly similar, both metal and sulphur diffusing. The diffusion rates of metal and sulphur increase to roughly the same extent with rising temperature. The rate of scale growth under given conditions increases from Ti-S to NiS that of Co-S, however, being anomalously low. There are 1 table and 16 references, 2 of which are Soviet and 14 Western.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im A.M. Gor'kogo
(Ural's State University im A.M. Gor'kiy)

SUBMITTED: March 31, 1959

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18.7530

67688
SOV/126-8-4-10/22

AUTHORS: Arkharov, V.I., and Blankova, Ye.B.

TITLE: Investigation of Reaction Diffusion in Binary Systems of the "Metal-Gas" Type. II

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 4, pp 569-573 (USSR)

ABSTRACT: The authors have given (Ref 1) the main facts associated with the diffusion mechanism in systems formed by fourth-group transition elements with sulphur. They follow this with the investigation (based on their own and published work) of systems of the same metals but with selenium or tellurium. The results on the mechanism of reaction-diffusion in the systems Ti-Se, V-Se, Cr-Se, Mn-Se, Fe-Se, Co-Se, Ni-Se, are shown in Table 1; temperature ranges (two for each system), number of macroscopic characteristics of the diffusion mechanism, nature of texture in the scale layer. Table 2 gives the corresponding information for the systems with Te. In the Cr-Se, Mn-Se, Fe-Se and Ni-Se systems (as in the corresponding systems with sulphur) a diffusion of the metal and selenium occurs over the whole temperature range (up to 1000 °C); but with Ti-Se, V-Se and Co-Se

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67697

SOV/126-8-4-21/22

187530

AUTHORS:

Arkharov, V.I., Blankova, Ye.B., Sukhova, N.A.,
and Entelis, R.A.

TITLE:

Investigation of Reaction Diffusion^{IV} in Binary Systems
of the Type "Metal-Gas". III

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 4,
pp 636-638 (USSR)

ABSTRACT: Arkharov and Blankova have previously (Ref 1) postulated
a correlation between an increase in the relative role
of homopolar bonding in diffusion-reaction products and
the increase in the relative role of the metalloid in
the diffusion process. To check this they have now
studied the mechanism of diffusion in the systems:
Fe-P, Co-P, Zr-S, Zr-Se, Zr-Te, Nb-S, Nb-Se and
Nb-Te. These are particularly suited, as the authors
explain, to studies of the postulated correlation. The
results are tabulated, showing for each system the
temperature range, the number of macroscopic layers,
number of metallographically distinct layers, phase
composition of the scale, whether there is texture in
the scale layers and the macroscopic characteristics of
reaction diffusion. Much of the information on scale

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Investigation of Reaction Diffusion in Binary Systems of the
Type "Metal-Gas". III

phase-composition is referred to published work by other authors. From their comparison of data obtained by various methods the authors conclude that at 400-600 °C uni-directional diffusion of phosphorus occurs in Fe-P and Co-P; in all the Zr and Nb systems uni-directional diffusion of metalloids is found at 400-1000 °C. These results and their comparison with those for other systems confirm that the increase in the relative role of homopolar bonding is associated with an increase in the relative role of the metalloids in diffusion reactions. There are 1 table and 10 references, of which 4 are Soviet, 5 German and 1 Scandinavian.

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ASSOCIATION: Ural'skiy gosudarstvennyy universitet imeni
A.M. Gor'kogo
(Ural's State University imeni A.M. Gor'kiy)

SUBMITTED: June 19, 1959

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SOV/126-8-5-11/29

AUTHORS: Arkharov, V.I., Klotsman, S.M., and Timofeyev, A.N.

TITLE: On the Effect of Small Additions on the Diffusion Coefficients in Polycrystalline Materials.
III - Effect of Thallium on the Self-Diffusion of Silver

PERIODICAL: Fizika metallov i metallovedeniye, Vol 8, 1959, Nr 5, pp 709-713 (USSR)

ABSTRACT: Silver (99.99%), remelted in vacuum, and chemically pure thallium were used as the raw materials in the investigation. Ag-Tl alloys were made in an argon atmosphere. Ingots of pure silver and of the alloy were cold forged into rods of 12 x 12 mm cross-section. All heat-treatment operations and diffusion annealing were carried out in a vacuum of the order of 10^{-1} to 10^{-2} mm Hg. The temperature was maintained with an accuracy of ± 1 °C. After forging, all specimens were recrystallized for 6 hours at 900 °C. The grain size of all specimens was practically the same, being approximately 1 mm. After recrystallization, the specimens of pure silver and of the alloy were subjected to one of the following variants of heat treatment: 1) annealing at 350 °C for 200 hours; 2) annealing at 285 °C for

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On the Effect of Small Additions on the Diffusion Coefficients in Polycrystalline Materials. III - Effect of Thallium on the Self-Diffusion of Silver

200 hours; 3) annealing at 170 °C for 200 hours; and 4) annealing at 170 °C for 200 hours, followed by annealing at 350 °C for 100 hours. Radioactive silver was applied to the surface of the specimens by evaporation in vacuum. All specimens, having undergone one of the above variants of heat treatment, were subjected simultaneously to diffusion annealing. The latter was carried out at 285 °C for 200 hours. The distribution of silver in the diffusion zone was determined by a layer analysis using the integral residue method. Measurements of the activity and thickness of the removed layers were carried out employing a method described by Arkharov et al (Refs 1, 2). Figs 1 and 2 are typical graphs for the dependence of the residual integral activity logarithm on the depth of diffusion in pure silver and in the alloy. In a table on page 711, values of diffusion permeability of intercrystalline members of polycrystals of pure silver and a silver alloy containing 0.1% Tl are shown. As can be seen from the

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On the Effect of Small Additions on the Diffusion Coefficients in Polycrystalline Materials. III - Effect of Thallium on the Self-Diffusion of Silver

results obtained, the temperatures of maximum adsorption enrichment of the intercrystalline members does not coincide with the temperature of maximum volume solubility. From the independence of the diffusion permeability of the intercrystalline transition zones in pure silver on preliminary heat treatment, it is concluded that the structure of these zones remains unaltered in the investigated temperature range. From data on the dependence of the diffusion permeability of intercrystalline members in the silver - 0.1% Tl alloy on preliminary heat treatment, the adsorption activity of Tl in Ag can be calculated. An experimental confirmation of Arkharov's hypothesis (Ref 8) on the existence of a temperature dependence of the degree of adsorption enrichment was obtained. The sign of the temperature dependence of the intercrystalline internal adsorption of Tl in Ag was derived. It is suggested that the excess energy in the intercrystalline transition zones decreases during adsorption of Tl, mainly due to

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On the Effect of Small Additions on the Diffusion Coefficients in
Polycrystalline Materials. III - Effect of Thallium on the
Self-Diffusion of Silver

its geometrical structure and not due to interatomic
reactions.

There are 2 figures, 1 table and 8 references, of which
6 are Soviet and 2 English.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals, Academy of Sciences
USSR)

SUBMITTED: May 20, 1959

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67772

18.7510

SOV/126-8-5-26/29

AUTHORS: Arkharov, V.I., Borisov, B.S., Vangengeym, S.D., and Taluts, G.G.

TITLE: On the Question of the Mechanism of Intercrystalline Internal Adsorption in Dilute Solid Solutions

PERIODICAL: Fizika metallov i metallovedeniye, Vol 8, 1959, Nr 5, pp 792-794 (USSR)

ABSTRACT: The interaction between the electron shells of atoms in a dilute solid solution can strongly affect the behaviour of impurity atoms in this solid solution. This applies particularly to intercrystalline internal adsorption. By taking into consideration the electron interaction it is possible to describe the atomic mechanism of internal adsorption and associate it with quantitative data available in this field. If there are defects or structural non-uniformities in the lattice the impurity atoms react with them. This is a long-range order interaction and hence screening must become evident, i.e. the impurity atoms must behave as if they possessed a "screened" atomic radius. As any structural non-uniformity (among them grain boundaries) can be considered to be a dislocation system, for an

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On the Question of the Mechanism of Inter-crystalline Internal Adsorption in Dilute Solid Solutions

approximate description of the interaction between impurity atoms in a solid solution and lattice distortions, it is possible to use Webb's calculation (Ref 11). In this way one can evaluate the number of atoms, N_0 , diffusing through the grain body to the dislocation system modelling the inter-crystalline boundary, i.e. the number of atoms experiencing inter-crystalline internal adsorption. Such a calculation was carried out by the authors for the solid solutions Ag-Tl, Ag-Zn, Ag-Pb, Cu-Mg and Cu-Sn. The concentrations of horophilic elements in these alloys were considerably lower than their volume solubility. The results of the calculations are reported in the table on p 793. Although the calculated and experimental results agree quite well, a discrepancy can be observed which in a few cases exceeds the absolute errors in lattice parameter measurements. Among the possible reasons for this discrepancy the following can be quoted. First, Webb's formula, which contains macroscopic factors, is somewhat artificial for the description of phenomena of an atomic

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On the Question of the Mechanism of Inter-crystalline Internal Adsorption in Dilute Solid Solutions

scale, and can be justified only as a first approximation. Secondly the influence of the relative orientations of neighbouring grains which can change the width of the inter-crystalline zone, and the associated lattice parameter (this change varying from one grain group to another) is not taken into consideration. Thirdly the block structure which can change from one test to another can, as a result of internal adsorption at block boundaries, change the magnitude of the lattice parameter somewhat. These facts are subjects for further investigation. There are 1 table and 11 references, of which 4 are Soviet, 6 English and 1 German.

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ASSOCIATION: Ural'skiy gosudarstvennyy universitet: Institut fiziki metallov AN SSSR
(Ural'sk State University: Institute of Physics of Metals, Acad.Sci. USSR)

SUBMITTED: June 19, 1959

SOV/126-8-6-10/24

AUTHOR: Arkharov, V.I.

TITLE: On the Question of Non-Uniformities in Concentration
Shown Experimentally to Exist in Solid Bodies 21

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 6,
pp 861-866 (USSR)

ABSTRACT: (Remarks in connection with papers by A.S.Zav'yalov and
B.I.Bruk)

The author discusses papers on this subject by Zav'yalov and Bruk (Ref 3 to 7) and disagrees with some of their interpretations. His own conclusions are as follows:
(1) The phenomena of origination of non-uniformity in concentration in the alloys studied by Zav'yalov and Bruk differ in nature from those of internal adsorption.
(2) The phenomena investigated by Zav'yalov and Bruk can be explained on the basis of simple thermodynamic circumstances which dictate the form of equilibrium diagram for the alloy; however, these explanations cannot be applied for internal adsorption phenomena because of the entirely different nature of the latter.

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(3) The thickness of the intercrystalline internal

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On the Question of Non-Uniformities in Concentration Shown
Experimentally to Exist in Solid Bodies

adsorption zones which can be estimated from experimental results obtained by different methods, have a magnitude of $10^2 - 10^3 \text{ \AA}$; a direct autoradiographic exposure of such zones is very difficult and is possible only under particularly favourable conditions in particular cases. The zones shown in the papers by Zav'yalov and Bruk have a thickness exceeding the cross-sectional dimensions of intercrystalline internal adsorption zones.

(4) Zav'yalov and Bruk's remarks about certain aspects of the internal adsorption phenomenon contain a number of misunderstandings due to an oversimplified idea about the mechanism of internal adsorption. There are 19 references, 18 of which are Soviet and 1 German.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Metal Physics, AS USSR)

SUBMITTED: July 20, 1959

Card 2/2

ARKHAROV, J.I

PHASE I BOOK EXPLOITATION

BOV/4535

Vsesoyuznyy sovet nauchno-tekhnicheskikh obshchestv

Mezhkristallitnaya korroziya i korroziya metallov v napryazhennom sostoyanii
(Intercrystalline and Stress Corrosion of Metals) Moscow, Mashgiz, 1960.
358 p. 3,000 copies printed.

Ed.: I.A. Levin, Candidate of Technical Sciences; Ed. of Publishing House:
I.I. Lesnichenko, Engineer; Tech. Ed.: V.D. El'kind; Managing Ed. for
Literature on Metalworking and Instrument Making (Mashgiz): V.V. Rzhavinskiy,
Engineer; Editorial Board: I.A. Levin, Candidate of Technical Sciences
(Chairman), V.P. Batrakov, Candidate of Technical Sciences, V.M. Nikiforova,
Candidate of Technical Sciences, and A.V. Turkovskaya, Candidate of Technical
Sciences.

PURPOSE: This collection of articles is intended for technical personnel concerned
with problems of corrosion of metals.

COVERAGE: The collection contains discussions of intercrystalline corrosion of
stainless steels and stress corrosion of carbon steels, low-alloy and stainless
steels, and light-weight and nonferrous alloys. The tendency of steels of

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S/148/60/000/003/008/018
A161/A029

AUTHORS: Arkharov, V.I.; Sidorenko, F.A.

TITLE: Crystallographic Correlations in Thermoelastic Martensite Transfor-
mation 16

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. - Chernaya metallurgiya, 1960
No. 3, pp 78 - 85

TEXT: The article presents the contents of a report delivered at the 6th scientific-technical conference on the application of X-rays for investigation of materials. The purpose of the report was to draw attention to certain features of the mechanism of thermoelastic martensite transformation in alloys investigated by G.V. Kurdyumov and L.G. Khandros (15.2% Al, 1.3% Ni, 83.5% Cu). These features were revealed by geometrical calculations based on the orientation correlation of the cubical β_1 and the low-temperature rhombical γ' phases established by Greninger (Ref. 1). The correlation is illustrated by superimposing the two crystallographic lattices (Fig. 1) (the shifts of atoms in transformation are marked by arrows). The transformation process is analyzed and the observed transformation hysteresis is explained by diffusion of atoms "wedged out" from the lattice in

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A161/A029

Crystallographic Correlations in Thermoelastic Martensite Transformation

transformation $\beta_1 \rightarrow \gamma'$. For more detailed explanation of the thermoelastic martensite transformation mechanism the authors determined the heat expansion coefficients of the Kurdjumov-Khandros alloy by roentgenographic means. The statements show the effect of dimensional correlations and their variations with temperature in the transformation process. There are 3 figures and 2 English references. ✓

ASSOCIATION: Ural'skiy gosudarstvennyy universitet (Ural State University)

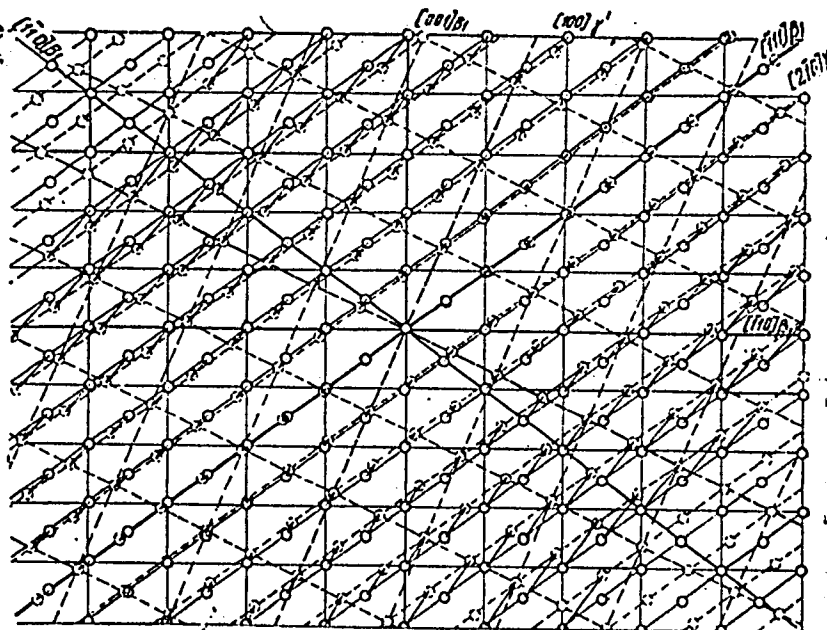
SUBMITTED: January 21, 1959

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Crystallographic Correlations in Thermoelastic Martensite Transformation

Figure 1:

Superimposition of the lattices of the $(110)\beta_1$ - and $(001)\gamma'$ -phases



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S/148/60/000/003/013/018
A161/A029

18.7500 1555, 1146, 1413

AUTHORS: Arkharov, V.I.; Blankova, Ye.B.

TITLE: Investigation of the Reaction Diffusion in Binary Systems with Transition Element Base

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. - Chernaya metallurgiya, 1960, No. 3, pp. 122 - 124

TEXT: The changes of the diffusion mechanism between binary systems with similar properties were studied. Commercially pure transition metals of the 4th period (Ti, V, Cr, Mn, Fe, Co, Ni) and oxygen-group metalloids (S, Se, Te) were chosen for the study. The interaction of solid metal specimens with vaporized metalloids was studied in the heat interval from the beginning of perceptible scale formation to 1000°C. Macroscopical analysis, microscopic investigation, layerwise roentgenographic analysis of the scale phases and experiments with inert marks were employed. The results led to the assumption that at least in the phases with perceptible metallic properties both the metal and the metalloid affect the quantity of quasi-free electrons, and the metalloid particles in the lattice become positively ionized. The observed fact that in systems with selenium the diffusion of metalloid is strongest in Ti-Se, V-Se and Co-Se, agrees with Card 1/2

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A161/A029

Investigation of the Reaction Diffusion in Binary Systems with Transition Element Base

the statement made by Ehrlich (Ref. 3) that the homeopolar and metallic bonds are strongest in these compounds. The following fundamental conclusions were drawn: 1) In binary systems of the 4th-period transitive elements from Ti to Ni, with S, Se and Te for the second component, the diffusion percentage of metal decreases and that of the metalloid increases in the series from sulfides to selenides and then to tellurides. Within the selenide series, the metalloid diffusion is strongest in systems with Ti, V and Co. 2) The easier diffusion of metalloids compared to that of metals is mainly due to homeopolar and metallic bonds in those phases which are the products of reaction diffusion. 3) As the radii of the atoms and of the negative ions of selenium and tellurium are much larger than the radii of the atoms and of the positive ions of metal, it may be supposed that metalloid particles are diffusing through scale (or at least through the scale layers consisting of NiAs and CdJ_2) in the form of positive ions. There are 3 references: 2 Soviet, 1 German.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet (Ural State University)

SUBMITTED: January 21, 1959
Card 2/2

24577

S/137/617000/005/030/060
A006/A106

18753D

AUTHORS: Arkharov, V. I., and Konev, V. N.

TITLE: On the joint diffusion of two elements into solid metal

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 5, 1961, 2-3, abstract
5Zh15 ("Tr. Seminara po zharostoykim materialam" [In-t metallo-
keramiki i spets. splavov AN USSR, no. 5] Kiyev, 1960, 37-42)

TEXT: A theoretical analysis is made of the joint diffusion of 2 elements into a third one in systems of a solid metal and a mixture of two chemically active gases: $Me - (X' + X'')$. Phase diagrams of the systems formed by compounds which exist in the binary systems of the $Me-X$ type, are classified. Cases are analyzed where the solubility of X' and X'' is unlimited, limited and absent in the binary compounds of the pseudo-binary system $Me_nX'_m - Me_pX''_q$. In the first case the diffusion layer consists of a single phase with a concentration gradient decreasing along the depth of the layer for both components. In the second case the surface layer consists of a phase with a higher content of the element with least diffusional mobility. At a certain depth a layer of another phase may exist with a higher concentration of elements with a greater diffusional mobility.

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On the joint diffusion ... 24577

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A006/A106

X

In the 3rd case on the metal surface first a layer is formed (or layers) consisting of phases which exist in the binary system: metal-element with a high chemical affinity with the metal. If X' and X'' interact, then the process will be determined and regulated by the reaction of the metal with the excessive element and with the phase of gaseous components formed again. The mechanism of diffusion in binary systems affects the diffusion mechanism in the system $Me-(X' + X'')$. Some factors are studied which affect the kinetics of the processes. The second case is experimentally confirmed by V. N. Konev and V. I. Arkharov and others (RZhMet, 1959, no. 11, 24702; "Fiz. metallov i metallovedeniye" 1952, v. 5, 192). The first and third case were not specially studied.

I. L.

[Abstracter's note: Complete translation]

Card 2/2

S/137/62/000/004/078/201
A052/A101

AUTHOR: Arkharov, V. I.

TITLE: Non-uniformity of component distribution in solid solutions

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1962, 5, abstract 4135
("Tr. In-ta fiz. metallov, AN SSSR", no. 23, 1960, 87 - 102)

TEXT: A review of the results of experimental investigations of internal adsorption in solids. A conclusion is drawn that in a real solid solution the distribution of admixtures must be, as a rule, non-uniform, and that a non-uniformity of distribution of concentration of adsorption origin in a number of cases is of a first class importance for the properties of a solid as a whole. A particularly strong effect on the properties of a solid has the internal adsorption of some small admixtures which, when their adsorption is eliminated or prevented, change inconsiderably the properties of a solid.

A. Rusakov

[Abstracter's note: Complete translation]

Card 1/1

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18.7500

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E111/E191

AUTHORS: Arkharov, V.I., Borisov, B.S., Vangengeya, S.D., and Sokolova, G.K.

TITLE: Investigation of the Connection between Internal Adsorption in Alloys and their Electrical Resistance

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 1, pp 81-85 (USSR)

ABSTRACT: The authors discuss methods which have been used for the experimental study of internal adsorption, noting the general difficulties of such investigations. Their own previous work (Refs 1-3) in which changes in lattice parameters associated with adsorption effects in many binary and ternary alloys were studied, was followed by an attempt to provide a qualitative explanation (Ref 4). Further work has shown that neither the thermodynamic nor a qualitative molecular-kinetic approach is sufficient to elucidate the mechanism of inter-crystallite internal adsorption. The authors show that internal adsorption, being related to the ionic sub-lattice of the crystal, must be closely connected with electronic processes in the dilute solid-solution lattice. They go on to

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E111/E191

Investigation of the Connection between Internal Adsorption in Alloys and their Electrical Resistance

consider the electrical resistance of dilute solid-solutions and then to describe experiments aimed at checking the model ideas by resistance determinations on such solutions relative to the grain size of polycrystalline specimens. The alloys studied were Cu - 1% Cd, Cu - 1% In, Cu - 0.6% Sn, and Cu - 1% Sb, made from electrolytic copper (99.99% Cu) and granulated (99.9%) other elements. Alloys were melted in quartz crucibles under borax and after forging and homogenizing annealing were cut longitudinally, each half being drawn into a wire 410 mm long and 0.3 mm in diameter. Resistance was determined at temperatures from -192 to +25 °C directly after drawing (curves 1 in a figure on p 84, showing resistance as a function of temperature) and after low-temperature (400-600 °C) tempering (curves 2) and high-temperature (800-900 °C) tempering followed by slow cooling (curves 3). Resistance for all alloys increased with temperature, decreased somewhat at any given temperature on low-

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Investigation of the Connection between Internal Adsorption in
Alloys and their Electrical Resistance

ASSOCIATION: Ural'skiy gosudarstvennyy universitet imeni
A.M. Gor'kogo
(Ural'sk State University imeni A.M. Gor'kiy)

SUBMITTED: October 9, 1959

Card 4/4

S/126/60/009/02/010/033
E111/E335

AUTHORS: Arkharov, V.I. and Konev, V.N.

TITLE: Investigation of Reaction Diffusion in "Metal-complex Gas" Systems. I. General Picture of the Phenomenon

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 2, pp 212 - 215 (USSR)

ABSTRACT: The authors point out that to be useful in technology, studies of diffusion with reaction should involve mixtures of gases as well as of solid phases. The general aim is to study such diffusion (especially gas corrosion and processes for making high-temperature coatings) and find practical methods of regulating these processes: for this many particular cases of systems of the type "solid element - mixture of two chemically active gaseous components" can be formulated. The authors discuss the significance of the type of equilibrium diagram of binary and ternary systems of the elements participating in diffusion with reaction. They examine three main types of pseudobinary systems in which reaction of the three components forms a scale with a phase composition corresponding to variations in the character

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E111/E335

Investigation of Reaction Diffusion in "Metal-Complex Gas" Systems.
I. General Picture of the Phenomenon

of pseudobinary equilibrium diagrams formed by chemical compounds contained in binary systems of the metal with each of the components separately. The authors also consider briefly the significance of the type of crystal structure of phases formed in the scale and finally indicate the possible importance of other factors, such as phase transformations in the metal during solution in it of the gaseous elements or formation of deposits on the solid surface through gas-phase reactions.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im. A.M. Gor'kogo (Ural State University imeni A.M. Gor'kiy)

SUBMITTED: November 2, 1959

Card 2/2



69687
S/126/60/009/03/007/033
E111/E452

/8. 8300

AUTHORS: Konev, V.N., Bogacheva, N.G. and Arkharov, V.I.
TITLE: Investigation of Diffusion with Reaction in the System
"Metal-Complex Gas". II. The System Chromium-
Sulphur-Dioxide ✓

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 3,
pp 358-361 (USSR)

ABSTRACT: This is a continuation of work by Arkharov and Konev
(Ref 1) to investigate the physical mechanism of
diffusion with reaction in systems of the type solid-
metal-mixture of chemically active gases. This
information is necessary for developing non-scaling
materials and understanding their failures in service.
The present work deals with Cr-O-S. Parallelepiped
specimens (1.0 to 1.5 cm side) of technical chromium
were suspended in a heated sealed quartz tube at 600 to
1200°C; the apparatus and procedure were described
previously (Ref 2 to 6). Fig 1 shows gains in weight
of specimens at the various temperatures (except 600 and
1200°C) per unit of surface as functions of time (hours).
Fig 2 shows a plot of the logarithm of the rate constant ✓

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E111/E452

Investigation of Diffusion with Reaction in the System
"Metal-Complex Gas". II. The System Chromium - Sulphur-Dioxide

against reciprocal of absolute temperature, the points relating to those in Fig 1, where the curves become horizontal. Specimens exposed under various conditions were subjected to qualitative X-ray analysis: a feature was the appearance of a new phase. Fig 3 shows lines from the outside (a) and inner (b) layers of a specimen oxidized in sulphur dioxide at 1200°C, some doubling of lines being evident in the latter. No texture in the outer layer of scale could be detected on any specimen. The scale contained 9.23 weight % of combined sulphur, according to analyses carried out in the Mineral Salts Laboratory of UNIKHIM. Heating of mixtures of Cr₂O₃ and CrS, or Cr₂O₃ and Cr₂S₃ at 800°C for 8 to 10 hours in vacuo (table gives compositions of mixtures and products) did not give the new phase present in the scale. The non-scaling properties of specimens previously treated under conditions producing the new phase were suspended in air at 1000 and 1100°C: in 12 hours no weight increase took place and the new phase remained. The investigation

Card 2/3

ARKHAROV, V.I.

Defining more accurately the concept of the localization of chemical reactions in the diffusion reaction in solids. Part 1. Partial delocalization of the reaction in a substitutional phase layer. Fiz. met. i metalloved. 9 no. 4:545-553 Ap '60. (MIRA 14:5)

1. Institut fiziki metallov AN SSSR.
(Diffusion) (Crystal lattices)

18. 7530
15. 2220

80529
S/126/60/009/05/008/025

AUTHORS: Arkharov, V.I., Konev, V.N. and Gerasimov, A.F.

TITLE: Investigation of Diffusion with Reaction in "Metal - Complex Gas" Systems. IV. The System Molybdenum-nitrogen-carbon

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 5, pp 695 - 700 (USSR)

ABSTRACT: This reports a further investigation by this school on diffusion with reaction in systems of the "metal - mixture of two chemically-active gases" type (Refs 1-7). V. Negodyayev and G. Tatymov participated in the experiments, which were carried out on the binary molybdenum-nitrogen (method described in Refs 15, 16) and molybdenum-carbon systems (method described in Refs 11,12) and then on the ternary molybdenum-nitrogen-carbon system (method described in Refs 3,4). Figure 1 shows increases in weight of molybdenum specimens in ammonia vapour as functions of time for 700 - 1 120 °C. Figure 3 the corresponding curves for a benzene-hydrogen atmosphere at 1 000 - 1 200 °C, and Figure 4 for a benzene-ammonia atmosphere at 1 000 - 1 200 °C. The dependence of the

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Investigation of Diffusion with Reaction in "Metal - Complex Gas" Systems. IV. The System Molybdenum-nitrogen-carbon

logarithm of the parabolic constant on reciprocal of absolute temperature is shown for all the systems in Figure 2 and the values of the constant are given in Table 2. The lines consist of three straight sections and the authors give a physical interpretation of this. Table 1 gives for all the systems the number of layers detected metallographically, the results of phase X-ray analyses and the presence or absence of texture at the various temperature ranges. Texture was found only in Mo-C at 1 200 °C. The work showed that molybdenum-nitrogen reaction in an ammonia atmosphere proceeds appreciably at 700 °C following the parabolic law up to 1 150 °C, above which molybdenum nitrides were not formed. At 700 - 940 °C a scale of an outer layer of MoN with a simple hexagonal lattice and an inner layer of Mo₂N with a face-centred cubic lattice was produced. There was no reaction between molybdenum and molecular nitrogen at atmospheric pressure and 600 - 1 200 °C. The reaction with carbon (from benzene + hydrogen) proceeded appreciably at

Card2/3

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AUTHORS: Arkharov, V.I., Konev, V.N. and Pavlova, V.P.

TITLE: Investigation of Diffusion with Reaction in "Metal - Complex Gas" Systems. V. The System Chromium-Sulphur-nitrogen

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 5, pp 701 - 708 (USSR)

ABSTRACT: This is a further contribution to the series of researches by this school on diffusion with reaction in systems of the "metal - mixture of two chemically-active gases" type (Refs 1-7). In the work the authors extended their previous experiments on the chromium-sulphur system (Ref 10) before proceeding to the ternary system with nitrogen. Hollow cylindrical (sometimes parallelepiped) specimens of electrolytic chromium were suspended by quartz in a furnace (Figure 1). For the binary system the heated vertical quartz tube was evacuated and its lower end was kept at 250 °C to give a sulphur vapour pressure of 12 mm Hg. For the ternary system the tube after evacuation was connected to a source of pure nitrogen. The products were examined as described

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Investigation of Diffusion with Reaction in Metal - Complex Gas" Systems. V. The System Chromium-sulphur-nitrogen

previously (Refs 1,8,9,12). The experiments were carried out at 700, 800, 900 and 1 000 °C at a constant sulphur partial pressure; nitrogen pressure was constant at 25 to 30 mm Hg (gauge). Table 1 gives the number of layers detected metallographically, the results of X-ray phase analysis, presence or absence of texture and the microscopic characteristics of the diffusion mechanism. Figure 2 shows typical appearance of a specimen initially and after treatment at 1 000 and 700 °C. Figure 3 shows a section through a specimen sulphided at 1 000 °C for 1 hour and Figures 4a and 4b one through a specimen treated with sulphur + nitrogen for 4 hours at 1 000 and 2 hours at 700 °C, respectively. The weight-gains of specimens under the various conditions are shown as functions of time in Figure 5 and the logarithm of the parabolic constant of the rate curves as functions of reciprocal of absolute temperature in Figure 6 (linear for the binary, complex for the ternary). Reaction diffusion in both systems follows the parabolic law for 700 - 1 000 °C (constant

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Investigation of Diffusion with Reaction in Metal - Complex Gas"
Systems. V. The System Chromium-sulphur-nitrogen

values are given in Table 2). The rate of scaling of the binary is greater than that of the ternary system. In the binary system the outer light layer approximates to Cr_2S_3 at 1 000 °C and Cr_3S_4 at 700 °C, while the dark inner layer approximates to Cr_5S_6 . The work showed that in this system the reaction diffusion involves movement of the components in both directions through the scale layer, the relative importance of chromium growing with increasing temperature. In the ternary system the process depends on diffusion of sulphur and nitrogen through crystal lattices to the metal and of chromium to the scale outer surface. There are 6 figures, 2 tables and 16 references, 13 of which are Soviet, 2 German and 1 international.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im.
A.M. Gor'kogo (Ural State University imeni A.M. Gor'kiy)

SUBMITTED: December 23, 1959
Card3/3

S/126/60/009/05/010/025
E111/E352

AUTHOR:

Arkharov, V.I.

TITLE:

Closer Definition of the Ideas on Localization of Chemical Reaction During Diffusion with Reaction in Solids.
II. Conditions for the Most Complete Localization of Reaction at the Boundaries of a Layer of a Substitution-type Phase

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 5, pp 709 - 717 (USSR)

ABSTRACT: The author gives a theoretical treatment of concentration distribution through a diffusion layer giving the greatest localization of chemical reactions at the layer boundaries. The type of distribution previously shown by him to be required for a solid solution based on a Me_mO_n compound is shown in Figures 1a and 1b, relating, respectively, to localization at the lefthand or righthand boundary. In Figure 1a all Me atoms, as soon as they are at the righthand side of the lefthand boundary, are practically completely combined with O atoms arriving by diffusion through the mass to form the compound with maximum excess of Me over the stoichiometric compound; at the other boundary the

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Closer Definition of the Ideas on Localization of Chemical Reaction
During Diffusion with Reaction in Solids. II. Conditions for the
Most Complete Localization of Reaction at the Boundaries of a Layer
of a Substitution-type Phase

concentration of Me falls to the lowest level corresponding to equilibrium of the compound with pure O. In Figure 1b the rôles of Me and O are reversed. Using his former notation the author deduces diffusion equations for the above cases. When reaction is localized simultaneously at both boundaries concentration distribution is represented by a combination of Figures 1a and 1b. The concentration distribution represented by these figures does not necessarily secure localization at one side. With more intensive diffusion of Me and of O their atoms can penetrate beyond the limits shown. The narrow zone where the concentration gradient is steep is formed in the earliest stage of reaction diffusion. The opposite sides of this phase represent composition deviating from the stoichiometric compound to coexist with pure Me and pure O, respectively. The possible forms of its further growth are shown in the series of Figure 2, concentration

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E111/E352

AUTHORS: Arkharov, V.I. and Blankova, Ye.B.

TITLE: Structural Characteristics of Scale Which are Used in the Investigation of the Mechanism of Diffusion with Reaction

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 878 - 887 (USSR)

ABSTRACT: The authors develop and give a more detailed treatment of the ideas published by one of them (Arkharov - Refs 1, 2) on the nature of the participation by components reacting with diffusion. They give the following as the cardinal questions. Do atoms diffuse as ions of "normal" or "average" valency or as neutral atoms with "normal" or "screened" radius? Is component movement effected through interstices or vacancies and do the atoms of a given component use only its own sublattice? The answers are obtainable from examinations of scale. Macrostructural studies are particularly fruitful but can become complicated. The authors discuss structural indications used for evaluating the degree of participation of components in the diffusion process. Texture in the scale layers is important, an increase in the growth texture indicating,

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Structural Characteristics of Scale which are Used in the
Investigation of the Mechanism of Diffusion with Reaction

under otherwise equal conditions, an intensified role of the given component in the overall diffusion process; but in their discussion of this effect the authors show that this is not unambiguous since recrystallization texture can also arise, and point to other possible complications. They emphasise that all structural characteristics in all scale layers should be examined. Grain size distribution also gives valuable indications (e.g. the presence in the scale layer of a finer-grain zone at the scale/solid boundary suggests diffusion of a component from the opposite scale boundary) but here, too complicating factors exist. Further evidence can sometimes be obtained from changes in the form of external scale surface, especially when one component is liquid or gaseous and the solid specimen is initially a rectangular parallelepiped: one-way diffusion of one component is detectable but with two-way diffusion of both the visible effects may disappear. Pfeil's (Ref 11) inert-marker method is useful if the relative size of markers is sufficiently small but their fixing is

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Structural Characteristics of Scale Which are Used in the
Investigation of the Mechanism of Diffusion with Reaction

difficult. Although each of the methods discussed gives only qualitative indications, the authors show that their suitable combination enables primary and secondary effects to be distinguished. They give a tabulation of these (Table 1) and note that further indications can be obtained from the concentration gradient, whose determination is, however, often difficult. Table 2 gives a scheme for grading observed effects to obtain the most reliable estimate of the role of each component in the process. There are 2 tables and 12 references, 9 of which are Soviet, 2 English and 1 German.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im. A.M. Gor'kogo (Ural State University imeni A.M. Gor'kiy)

SUBMITTED: December 26, 1959

✓B

Card 3/3

ARKHAROV, V.I.

S/126/60/010/01/007/019

E111/E335

AUTHORS: Arkharov, V.I. and Blankova, Ye.B.

TITLE: The Degree of Participation of Components in Diffusion
with Reaction in High-temperature Oxidation of
Certain Transition Metals.

PERIODICAL: Fizika metallov it metallovedeniye, 1960, Vol.10,
No. 1, pp 63 - 69

TEXT: The authors have previously studied diffusion in a number of binary systems in which one component is a fourth or fifth-group transition metal and the other is either sulphur, selenium or tellurium (Refs.1-3). To obtain a fuller and more correct background on the mechanism of the high-temperature oxidation of metals the authors now relate, using mainly published but some original data, these results to those on similar systems in which oxygen participates in place of sulphur, etc. To evaluate the degree of participation of components in diffusion they use their previously described system (Ref.4). Published data for titanium (Refs5-10) show that on their system (Ref,4) the mechanism differs depending on whether the temperature is above or below 900 °C: at higher temperatures ✓

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E111/E335

The Degree of Participation of Components in Diffusion with
Reaction in High-temperature Oxidation of Certain Transition
Metals

the role of metal diffusion increases. Vanadium[✓] (Ref.11) has
a first stage of scaling (400 - 600 °C in air) in which oxygen
diffusion and reaction occurs in the metal/scale interface;
later metal diffuses. Previous conclusions (Ref. 12) on
diffusion in chromium oxidation require revision in the light
of later work (Ref. 13); there are indications, however, of
oxygen diffusion, although data are insufficient for firm
conclusions. With manganese diffusion is in both directions
(Ref. 16). The authors describe additional experiments with
inert markers (Figure 1) which suggest that manganese
diffusion plays the greater part. With iron, oxygen diffusion
predominates below 400 °C; at higher temperatures both elements
diffuse and the scale has a complex character (Refs.18-20). The
authors report additional experiments with cobalt (Fig. 2 shows
appearance of a specimen with platinum wire on its surface,
oxidised in air for 8 hours at 1000 °C): these confirm previous
indications (Refs 20, 21) that intensive diffusion of oxygen ✓
Card 2/4

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E111/E335

The Degree of Participation of Components in Diffusion with
Reaction in High-temperature Oxidation of Certain Transition
Metals

occurs. Dealing with nickel the authors discuss divergent published results (Refs. 20-24) and suggest an explanation which is contrary to calculations based on Wagner's theory. Oxidation of zirconium, niobium and molybdenum and tungsten occurs by diffusion of oxygen. Finally, the authors deal with two non-transition metals, copper and zinc. For the former additional experiments (Fig. 3 shows an inert marker in a fully oxidized specimen) supported the view (Refs. 27-29) that copper-ion diffusion is mainly responsible and not two-directional diffusion (as suggested in Refs. 30 and 31). Zinc is oxidized with diffusion of the metal (Ref. 32). For both copper and zinc the mechanisms are in good agreement with Wagner's theory. The authors assign the type of diffusion for each of the transition metals to the classification proposed previously (Ref. 4).

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The Degree of Participation of Components in Diffusion with
Reaction in High-temperature Oxidation of Certain Transitions
Metals

There are 3 figures and 32 references: 15 Soviet, 13 English,
2 German. 1 Czech and 1 Scandinavian.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im.
A.M. Gor'kogo (Ural State University im.
A.M. Gor'kiy)

SUBMITTED: March 21, 1960

Card 4/4

ARKHAROV, V.I.

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S/126/60/010/02/008/020

E111/E352

18-7530

AUTHORS: Arkharov, V.I. and Blankova, Ye.B.

TITLE: Investigation of Diffusion with Reaction in Binary Systems of the Type "Metal-Gas". IV.

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol. 10, No. 2, pp. 226 - 232

TEXT: The authors continue their series of investigations (Refs. 1, 2) aimed at elucidating the factors determining diffusion mechanism in metal-gas systems. They review their previous conclusions and analyse further experimental data. They conclude from this and general theoretical considerations that the main crystallographic factor is the nature of the bonding forces between the components in the reaction-product crystal lattice. In systems "transition metal-metalloid (or gas)" an increase in the relative importance of homopolar bonds in compounds can be related to increase in the relative role of diffusion of the metalloid in the overall reaction diffusion process. They suggest that an elementary diffusion function is possible in which, because of existence of homopolar bonds, a local redistribution of electron density occurs with formation

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Investigation of Diffusion with Reaction in Binary Systems of the Type "Metal-Gas". IV.

of an atomic complex including a metalloid ion located in the vacancy of the metal sub-lattice, and its closest surrounding ions of metal with locally charged valency. This provides an explanation for the experimentally observed change in the relative role of diffusion of the components when the composition of binary diffusion systems is varied, particularly in those cases which are not explicable on purely crystallogometrical considerations. On the basis of these ideas the authors examine and explain reaction-diffusion mechanism in a number of binary systems, including titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, zirconium, niobium, molybdenum and tungsten, with oxygen, sulphur, selenium or tellurium; also in Fe-P, Co-P and Ni-P. There are 1 table and 16 references: 10 Soviet, 3 English, 2 German and 1 international.

ASSOCIATION: Ural'skiy gosudarstvennyy universitet im.
A.M. Gor'kogo (Ural State University im.
A.M. Gor'kiy)

SUBMITTED: March 21, 1960
Card 2/2

ARKHAROV, V.I.; BORISOV, B.S.; VANGENG'YH, S.D.

Revealing the characteristics of crystallite interlinking in an
X-ray scattering image. Fiz. met. i metalloved. 10 no.3:367-374
S '60. (MIRA 13:10)

1. Institut fiziki metallov AN SSSR i Ural'skiy gosudarstvennyy
universitet im. A.M. Gor'kogo.
(Crystal lattices) (X rays--Scattering)

ZHDANOV, German Stepanovich; BELOV, N.V., akad., retsenzent; ARKHAROV, V.I.,
prof., retsenzent; BELOV, K.P., prof., retsenzent; ZAKHAROVA, M.I.,
prof., retsenzent; GOL'DENBERG, G.S., red.; GEORGIYHVA, G.I., tekhn.
red.

[Solid-state physics] Fizika tverdogo tela. Moskva, Izd-vo Mosk.
univ., 1961. 500 p. (MIRA 14:6)
(Solids)

34537

S/659/61/007/000/024/044
D217/D303

18.1734

AUTHORS: Arkharov, V.I., and Konev, V.N.

TITLE: Investigating the diffusion kinetics for reaction within systems consisting of metals with complex vapors

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 221 - 226

TEXT: An analysis of various structures found in the diffusion layers of diffusion-reaction products, within systems consisting of metals in the presence of two chemically active gases, was carried out. Structural pictures of diffusion-reactions were obtained for the systems Cr-O, Cr-C, Cr-N, Cr-S, Cr-S-N, Cr-S-O, Cr-N-O and Cr-N-C. The structural pictures obtained were tied up with general theories on the reaction mechanism of complex systems of the above type. It was established that it is possible in principle to use diffusion-reaction layers in the systems Cr-C, Cr-C-N, Cr-O-S as protective coats. There are 1 figure, 1 table and 4 Soviet-bloc references.

Card 1/1

X

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18.9200 1145, 1418, 1555

S/126/61/011/003/005/017
E193/E483

AUTHORS: Arkharov, V.I., Borisov, B.S. and Vangengeym, S.D.
TITLE: Manifestation of the Process of Internal Intergranular
Adsorption in the X-Ray Scattering Pattern
PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.3,
pp.388-391

TEXT: It was shown earlier by the present authors (Ref.8) that the phon intensity of X-ray diffraction patterns, obtained on massive polycrystalline specimens, is higher than that of patterns produced by powder specimens of the same material with grains of the same size. This effect, attributed to the presence of an amorphous layer in the polycrystalline specimens, was much less pronounced in pure materials which indicated preferential adsorption of the impurity atoms in the grain boundary regions. The data, then obtained, were insufficient to form any conclusive opinion regarding the behaviour of impurities in the region of intercrystalline internal adsorption and to determine whether these impurities are present in the solid solution or in the second phase; hence, the investigation described in the present paper. As before, the experiments were carried out on Card 1/4

Manifestation of the Process ...

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X

both massive and powder specimens, characterized by the same grain size. The experimental materials consisted of electrolytic copper (99.94% purity) and a Cu-base alloy containing 0.35 wt.% antimony. The results of the measurements of the intensity of X-ray scattering are reproduced graphically. In Fig.1, the intensity of the scattered X-ray beam (I , pulses/min) is plotted against the diffraction angle 2θ for (a) plastically deformed specimens, (b) specimens annealed for 2 h at 400°C and (B) specimens annealed for 6 h at 800°C, the continuous and broken curves relating respectively to massive and powder Cu specimens. The results obtained for the Cu-Sb specimens are presented in the same manner in Fig.2, except that graphs (b) and (B) relate respectively to specimens annealed for 2 h at 450°C and for 6 h at 970°C. It will be seen that whereas the $I(2\theta)$ curves for the massive polycrystalline specimens of both Cu and Cu-Sb alloy showed intensity peaks (shifted for the (111) lines of Cu towards the smaller values of 2θ), no intensity peaks were observed on curves constructed for the powder specimens. Since no peaks were observed on the $I(2\theta)$ curves for massive specimens of high (99.999%) purity copper, it was concluded that these peaks are associated with the

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formation of a small quantity of a new phase, precipitated in the region of intercrystalline internal adsorption from the locally supersaturated solid solution. In the case of electrolytic copper in which tin was the main impurity, the appearance of the X-ray scattering intensity peak was caused by the formation of the Cu_3Sn phase; the peak on curves, constructed for the Cu-Sb alloy, was due to the precipitation of the Cu_3Sb phase. There are 2 figures and 9 references: 7 Soviet and 2 non-Soviet.

ASSOCIATIONS: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)
Ural'skiy gosudarstvennyy universitet im. A.M.Gor'kogo
(Ural State University imeni A.M.Gor'kiy)

SUBMITTED: October 3, 1960

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21218

Manifestation of the Process ...

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E193/E483

Fig.1.

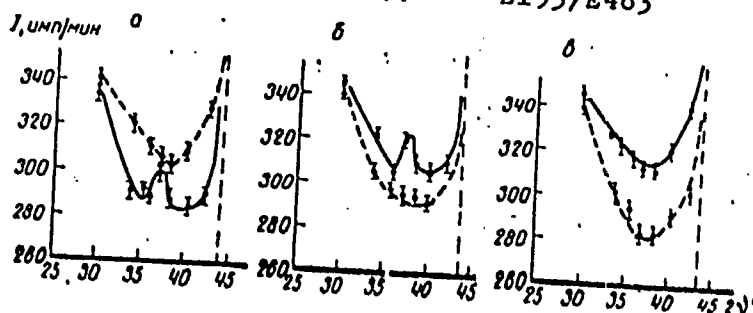
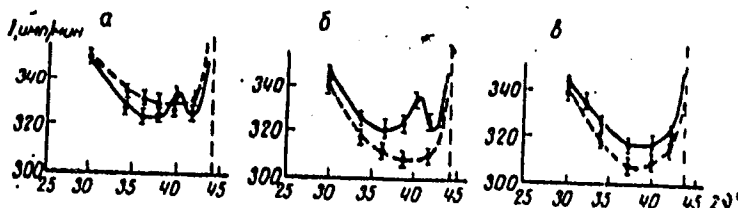


Fig.2.



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Please insert Fig.1 from 205319 and Fig.2 from 205320

ARKHAROV, V.I.

Thermodynamic explanation of internal adsorption in solids. Fiz.
met. i metalloved. 12 no.1:151-153 J1 '61. (MIRA 14:8)

1. Institut fiziki metallov AN SSSR.
(Solutions, Solid) (Adsorption)

S/126/61/012/002/007/019
E202/E335

AUTHOR: Arkharov, V.I.

TITLE: Problems of Modelling the Structure of Inter-crystallite Bonding

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol. 12, No. 2, pp. 223 - 232

TEXT: A general method of elucidating the structure of the intercrystallite bonding is described. This method can be looked upon as an extension and considerable generalisation of the Hargreaves and Hill (Ref. 2 - J. Inst. Metals, 1929, 41, 269) model. The new model is extended to three dimensions and is applicable to any type and angle of dislocation. The author assumes that regardless of the thickness of the inter-crystallite transition zone, the position of the atoms in the central part of the transition zone is affected equally by the two differently orientated lattices meeting at the boundaries of the two respective crystallites. Hence, the position of these central atoms should be intermediate between that which they would have occupied, were they the peripheral atoms of one of the crystallites in the absence of the other and vice

Card 1/6

Problems of Modelling

S/126/61/012/002/007/019
E202/E335

versa. This intermediate position is found by taking the projections of each of the adjacent crystallites which in a given disorientation lie nearest to the plane parallel to the plane of the boundary. In this way a system of double configuration is plotted, comprising point intersections of the two projections, which forms a kind of two-dimensional raster. This model is extended further by introducing a three-dimensional concept, viz. a packet of crystallographic planes which contains a known number of intersections within the boundary of a right parallelepiped. It is the latter which can be looked upon as a unit cell of the intercrystallite bonding structure modified by the mutual interaction of the differently orientated regions. For each crystallite bonding, the number of planes in a packet is chosen in such a way that it is equal to the number of intersections (i.e. the number of atoms) in the elementary unit in both of the packets compared, and the packets chosen in this manner are defined as equivalent packets. The ultimate structural model

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Problems of Modelling

S/126/61/012/002/007/019
E202/E335

is based on the supposition that a number of successive equivalent packets is positioned along the normal to the plane of the boundary. By taking two equivalent packets in a given disorientated intercrystallite bonding, correlating their thickness and then superimposing them in such a way as to make the vertices and sides of the elementary parallelipipeds coincide, a three-dimensional "grid" is obtained. On it, the lines joining the two adjacent points of intersection are the lines of dislocation by means of which the crystallographic lattice of one orientation can be transformed in the simplest way into a lattice of the same crystallographic type but different orientation. Consequently, the midpoints of these lines will correspond to the positions of the atoms in the centre of the transitional zone between the two crystallites. The above argument is applied to the study of the intercrystallite zone by superimposing two crystallographic projections, viz. (100) and (111) of a primitive cubic lattice, with the orientation [001] parallel to [110]. This yields an elementary rectangular loop $7a \times 5a$. Next, knowing the reticular density for (100) and (111) the minimum number of



Problems of Modelling

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E202/E335

planes in the corresponding equivalent packets is found to be 4 and 7, respectively, and the stress corrected number of atoms per unit surface of the projection in each packet - 4. Similarly, the total number of atoms in each of the elementary parallelepipeds is 140. In packet (100) each of the four planes contains 35 atoms, while in (111) each of the seven elementary parallelepipeds, the seven planes of (111) must transform into the four planes of (100), and this can be only achieved by shifting the atoms from layers II, IV and VI, of (111) into the last four layers so as to bring the total in each layer to 35 atoms. This is illustrated in Fig. 2, which shows the schematic cross-section of the intercrystallite bonding, at a right-angle to the plane of the boundary. Now, it is possible to draw the positions of atoms in each of the layers and thus elucidate the whole structure of the intercrystallite zone.

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Problems of modelling.

S/126/61/012/002/007/019.
E202/E335

There are 6 figures and 13 references: 5 Soviet and 8 non-Soviet. The four latest English-language references quoted are: Ref. 3 - J.M. Burgers - Proc. Phys. Soc., 1940, 52, 23; Ref. 4 - W.L. Bragg - Proc. Phys. Soc., 1940, 52, 105; Ref. 5 - W.T. Read, W. Shockley - Phys. Rev., 1950, 78, 275; Ref. 6 - N.F. Mott - Proc. Phys. Soc., 1948, 60, 391

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals of the AS USSR)

SUBMITTED: December 20, 1960

Card 5/6

10-8300

32659

S/126/61/012/005/019/028
E073/E535

AUTHORS: Arkharov, V.I., Gerasimov, A.F. and Ushkova, T.V.
TITLE: On high temperature oxidation of niobium
PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.5, 1961,
761-763

TEXT: The authors investigated the oxidation of metallic niobium in air in the temperature range 700 to 1200°C. The kinetic measurements were made by the method of continuous weighing; the phase composition of the products of oxidation were determined by means of X-rays, with Fe-K α -radiation, and by the Debye method using cylindrical and flat specimens. The kinetic measurements confirmed the results obtained earlier by W. Klopp, C.T. Sims and R. J. Jaffee (Ref.4: J. Trans. ASM, 1959, 51, 282) on the linear increase of scale and the anomaly of the oxidation speed at 800°C. According to Klopp et al., this anomaly may be due to the geometry of the specimen, to differences in the air humidity from one test to another and to sintering of the scale at high temperatures. The authors of this paper studied the kinetics of oxidation on specimens of various shape, applying various air

Card 1/2

S/126/61/012/006/008/023
E132/E135

AUTHOR: Arkharov, V.I.

TITLE: Regions of coherent reconstruction of the crystal
lattice in phase transformations in solid bodies

PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.6, 1961,
853-859

TEXT: Methods are given for calculating the form and
dimensions to be expected for coherent regions of a new solid
phase produced by a solid-state transformation from an initial
solid phase. Starting from a certain atom which is assumed to
be unchanged in position by the transformation, the displacements
of other atoms increase with distance from the first, depending
on the relationship between the two structures, until the
displacement approaches half a unit cell dimension. After this
it may be easier for successive atoms to move in the opposite
direction from a new centre. The size of the particles
generated is thus limited and is expected to be larger when the
displacements giving the new phase are smaller.

Card 1/2

Regions of coherent reconstruction... S/126/61/012/006/008/023
E132/E135

Theoretical examples of the calculation are given but actual substances, for example martensitic transformations, will be treated in a later paper.
There is 1 Soviet-bloc reference.

ASSOCIATION: Institut fiziki metallov, AN SSSR
(Institute of the Physics of Metals, AS USSR)

SUBMITTED: June 16, 1961

Card 2/2

ARKHAROV, V.I.; VANGENGELM, S.D.

Effect of internal adsorption on the results of precision
measurements of polycrystal lattice constants. Zav.lab. 27
no. 6: 683-686 '61. (MIRA 14:6)

1. Institut fiziki metallov AN SSSR i Ural'skiy gosudarstvennyy
universitet imeni A.M. Ger'shego,
(Adsorption) (Crystal lattices)

S/032/61/027/006/012/018
B124/B203

AUTHORS: Arkharov, V. I., Sokolova, A. A., and Shangareyev, F. L.
TITLE: Chamber for collimated X-raying of polycrystalline flat specimens
PERIODICAL: Zavodskaya laboratoriya, v. 27, no. 6, 1961. 751 - 753

TEXT: In the variant of an X-ray chamber (Fig.) developed by the authors, specimen 1 is placed on the object stage 2 and fixed by screw 3. The microsection surface is fixed, and coincides with the vertical front surface of the object stage. The latter can be adjusted vertically and horizontally by two micrometric screws; besides, it can move round the vertical axis together with the frame with the aid of a support in a cylindrical, vertical housing attached to the bench slide. The position with respect to this axis is read from a scale on which zero corresponds to the position of the specimen surface perpendicular to the axis of the collimator 4 which is placed in the casket 5 for taking inverted images. Parallel to the principal optical bench on the base of the chamber.

Card 1/4

Chamber for collimated X-raying...

S/032/61/027/006/012/018
B124/B203

there is a second bench 6 over which the slides are moving, which carry the auxiliary stage 7 with two glass prisms 8 with inside total reflection. This stage is moved by the micrometric screw 9. In the back part of the chamber, the microscope 10 is laterally fixed reaching a 15-fold magnification. With the chamber, it is possible to photograph a number of adjacent microsections successively. With the chamber, it is also possible to photograph sufficiently thin specimens in transmitted rays, as well as ground sections with rotation of its surface under an angle to the axis of the primary beam of rays, the angle of swing being read from the rear scale. For this purpose, the semicylindrical casket 11 is screwed to the front side of the frame; the film is placed in this casket. The film is pressed against the casket by the fixing screw 12. Specimens larger than the diameter of the object stage are glued onto the front side of the frame. In collimated X-raying with microbeams of rays, a third bench is placed on the bottom of the chamber, parallel to the chamber axis. To this bench, the slide can be fixed which carries the stand for the collimator of the microbeam of rays. There is 1 figure.

Card 2/4

Chamber for collimated X-raying....

S/032/61/027/006/012/018
B124/B203

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of
Physics of Metals of the Academy of Sciences USSR)

Card 3/4

S/180/62/000/004/006/009
EO40/E435

AUTHORS: Arkharov, V.I., Kuznetsov, E.N. (Sverdlovsk)
TITLE: On the fine structure of crystalline lattice during
polymorphic transformations in cobalt and titanium

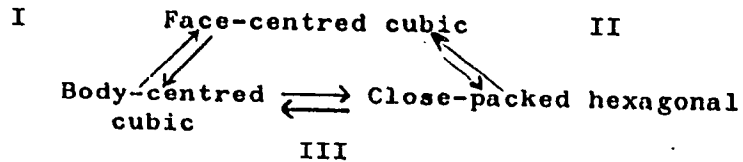
PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye
tekhnicheskikh nauk. Metallurgiya i toplivo,
no.4, 1962, 143-152

TEXT: Directional bonds are known to exist between crystal lattices of the original and new phases formed during polymorphic transformations in cobalt and titanium; the microstructure of the resultant products of the transformation and their kinetics and temperature dependence differ from that of martensitic transformation in carbon steel, therefore calculations were made of the dimensions and shape of coherent zones present during polymorphic transformations in the crystal lattices of cobalt and titanium. These studies together with available knowledge of the martensitic transformation in steel contribute to the elucidation of the mechanism of the following system of crystal lattices:

Card 1/3

On the fine structure ...

S/180/62/000/004/006/009
E040/E435



Results are given of calculation of coherent regions for type II and type III transformations in Co and Ti, using essentially the method given previously (Fiz. metallov i metalloved., v.12, no.6, 1961, 853). Basic parameters are tabulated of coherent regions in the β -transition in cobalt (at 450°C) and Ti (at 882.5°C) and the dimensions are given of the β and α -crystal lattices for both metals. Graphical studies were made by superposition of the (111) β and (001) α -phases. It is concluded that the coherency region in Co during transition from the β to α state is in the form of a thin and comparatively narrow but long strip. In Ti, the coherent region is narrower and shorter than in Co, its thickness being approximately of the same order. Comparison of the

Card 2/3

On the fine structure ...

S/180/62/000/004/006/009
E040/E435

transformations in Co and Ti with the martensitic transformation in steel indicates that the three types of transformation produce essentially different shapes and characters of the coherent regions. The absolute size of the regions is also different. The above differences might provide a basis for studying the causes of the differences in the microstructure of the transformation products and their properties, which depend on the microstructure. There are 6 figures and 5 tables.

SUBMITTED: March 2, 1962

Card 3/3

ARKHAROV, V.I.; KORENDYASEVA, Z.V.

Regions of coherent rearrangement of crystal lattices during
martensite transformations in carbon steel. Fiz.met.i metalloved.
13 no.1:97-106 Ja '62. (MIRA 15:3)

1. Institut fiziki metallov AN SSSR.
(Steel—Metallography) (Crystal lattices)

S/126/62/013/004/011/022
E111/E435

AUTHOR:
TITLE:

Arkharov, V.I.

On the problem of regions of coherent rearrangement of the crystal lattice during the martensitic transformation in low-carbon steel and iron

PERIODICAL: Fizika metallov i metallovedeniye, v.13, no.4, 1962, 567-571

TEXT: For studying ordered diffusionless phase transformations it is important to elucidate factors governing the orientational relationship. Therefore a comparison is made of the dimensions and shape of the regions of coherent rearrangement, as calculated by relationships proposed by G.Kurdyumov and G.Zaks (Vestnik metallopromyshlennosti, 1930, no.9-10, 165; Zs. Physik, 1930, 64, 325) on the one hand and by G.Wassermann, K.Mitt (W. Inst. Eisenforsch., 1935, v.17, 149) and Z.Nishiyama (Sci. Rep. Tohoku Imp. Univ., 1934, v.23, 637) on the other, for carbon-free iron (for which the relationship was found experimentally) and for steels with 0.33 and 1.52% carbon (for which the Kurdyumov-Zaks relationship was found). The applied method of calculation

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APPROVED FOR RELEASE: 06/05/2000

On the problem of regions ...

S/126/62/013/004/011/022
E111/E435

is described in a previous paper (FMM, 1961, v.12, no.6). The results show that when the austenite lattice rearrangement follows the Wasserman-Nishiyama mechanism the coherent region is "needle-like". The same happens with the Kurdjumov-Zaks mechanism, but then the needle-length is considerably greater (10 times for austenite with 1.52% C, 5 to 5.8 times for low-carbon iron). Transverse dimensions depend less on the carbon content and are 1.5 to 2 times greater for the Wassermann-Nishiyama mechanism. The needle-axes direction is different in the two mechanisms, as are the axial ratios of the coherent regions (more equiaxial in the Wassermann-Nishiyama). These and other differences could have a great effect on the formation of the martensite microstructure which proceeds by linkage of adjacent coherent regions. There are 3 figures and 5 tables.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

SUBMITTED: November 17, 1961

Card 2/2

247500

S/126/62/014/001/006/018
E071/E135

AUTHORS: Arkharov, V.I., Klotsman, S.M., Timofeyev, A.N., and
Trakhtenberg, I.Sh.

TITLE: An investigation of diffusion properties of
monochalcogenides of transitional metals. II.
Self-diffusion in polycrystals

PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.1, 1962,
68-74

TEXT: Since no results of investigations of the laws of
intercrystalline diffusion in chemical compounds have been
published and study of these laws on polycrystalline chemical
compounds and their comparison with the laws for elementary
substances would give a basis for modelling the structure of
intercrystalline linkages in chemical compounds, self-diffusion of
Ni in mono- and polycrystals of nickel monosulphide in the
temperature range 400-800 °C was studied radiometrically and by
autoradiography. Both compounds were obtained by reaction between
the individual components in evacuated and sealed ampules,
subsequent melting and homogenation. Chemical and X-ray
Card 1/2

✓A

An investigation of diffusion ...

S/126/62/014/001/006/018
E071/E135

diffraction analyses confirmed that the specimens were single phased with a structure of the NiAs type. The diffusion was measured on specimens 3-4 mm in diameter and 10 mm thick, one face of which was covered with the diffusion source by vacuo spraying, using Ni^{53} , Co^{60} and Te^{125m} as diffusing elements. Unlike pure metals, predominant self-diffusion in polycrystals along the grain and mosaic block boundaries occurs at temperatures considerably above 0.6-0.7 of the melting temperature and the ratio of inter-crystalline diffusion permeability to the "volume" coefficient of self-diffusion amounts to $10^{-1} - 10^{-2}$ cm³/sec. In single crystals of nickel monosulphide predominant diffusion along the grain and mosaic block boundaries occurs at even 0.6 times the melting temperature. The mechanism of scale formation during the process of reaction diffusion can be best studied by measuring the parameters of volume and boundary diffusion of phases entering the composition of the scale. There are 4 figures.

ASSOCIATION: Institut fiziki metallov AN SSSR

Card 2/2 (Institute of Physics of Metals, AS USSR)

SUBMITTED: November 10, 1961.

ARKHAROV, V.I.

Submicrostructure and habitus of martensite. Fiz.met.1 metalloved.
14 no.5:701-714 N '62. (MIRA 15:12)

1. Institut fiziki metallov AN SSSR.
(Steel—Metallography) (Martensite)

S/136/63/000/002/006/006
E193/E383

AUTHORS: Arkharov, V.I., Borisov, B.S. and Ibragimova, D.M.

TITLE: Gaseous corrosion and embrittlement of technical-grade nickel

PERIODICAL: Tsvetnyye metally, no. 2, 1963, 72 - 76

TEXT: Tubes made from technical-grade nickel by a process entailing frequent heating of the metal in a gas-filled furnace often show a tendency to cracking. The object of the present investigation was to establish the cause of this fault. The experimental work comprised the following: metallographic examination of specimens of technical-grade nickel and high-purity nickel with small additions of silicon, magnesium, iron, zinc or copper, heated to 1150 - 1200 °C in a gas-filled furnace or in an argon/SO₂ mixture; X-ray diffraction analysis of nonmetallic phase in an internally oxidized layer formed underneath the oxide scale; impact tests; study of the process of internal oxidation with the aid of a hot-stage microscope. The results can be summarized as follows. 1) The main cause of brittleness of technical-grade nickel tubes is internal oxidation of magnesium and silicon
Card 1/2

Gaseous corrosion

S/136/63/000/002/006/006
E193/E383

introduced initially into the metal during smelting as deoxidizing agents, the embrittling effect of magnesium being more pronounced.
2) No internal oxidation was observed in specimens prepared from pure nickel with up to 0.5% additions of iron, copper or zinc.

3) In the absence of sulphur, the rate of inter- and intra-granular internal oxidation was the same. In the presence of sulphur, a low-melting Ni-S eutectic, formed at the grain boundaries, seemed to facilitate the grain-boundary diffusion of oxygen which aggravated the embrittling effect of internal oxidation to such an extent that individual grains broke off the surface layer.

4) The following measures should eliminate or lessen the risk of embrittlement of nickel: replacing magnesium and silicon by other deoxidizing agents such as zinc; preheating the metal in vacuum or in a neutral atmosphere; ensuring that neither the metal nor the furnace atmosphere are contaminated with sulphur.
There are 6 figures.

Card 2/2

ARKHAROV, V. I.

AID Nr. 974-14 22 May

DIFFUSION COATINGS AND REFRACTORY COATINGS (USSR)

Metallovedeniye i termicheskaya obrabotka metallov, no. 3, Mar 1963, 59-61.
S/129/63/000/003/009/008

The Second Seminar on Diffusion Coatings of Metals and Refractory Compound Coatings on Metallic and Nonmetallic Materials was held 10-12 October 1962 in Odessa. B. N. Arzamasov (Moscow Higher Technical School imeni Bauman) reported on Si-coatings on Mo, W, and Ta and Al-coatings on Mo and W produced by a circulation method in which Si and Al chlorides and gaseous HCl are circulated, i. e., reused. This method improves the quality of coatings and the efficiency and economy of the process. G. N. Dubinin (Moscow Aviation Institute) spoke on the electrical and magnetic properties of "10" and "410" steels diffusion coated with Cr, Mo, W, Si, and Ti, and of copper and aluminum diffusion coated with Ti, Cr, Si, and B. A. P. Epik discussed C and B diffusion coatings on Ti, Zr, Nb, and Ta, the kinetics of formation of carbide

Card 1/2

AID Nr. 974-14 22 May

DIFFUSION COATINGS [Cont'd]

8/129/63/000/003/009/009

and boride layers, the structure and phase composition of these layers, and some properties for different conditions of coating. V. I. Arkharov spoke on the crystallography of phase transformations and reactions. N. V. Titov (Odessa Marine Academy) suggested a method for the approximate calculation of the deformation of a metal during its impregnation with other metals. N. F. Lashko discussed Si diffusion coatings on Nb and Nb-alloys. M. I. Simonova reported on cation distribution in oxides with spinel structure, which are formed on some alloy steels. These data are of great importance for the investigation of diffusion in oxide systems. [DV]

Card 2/2

ACCESSION NR: AT4013959

S/2659/63/010/000/0239/0246

AUTHOR: Arkharov, V. I.; Konev, V. N.; Nesterov, A. F.; Andrianovskiy, B. P.; Glazkova, I. P.

TITLE: Investigation of metal oxidation in sulfur-saturated air

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 10, 1963, 239-246

TOPIC TAGS: oxidation, sulfur, titanium chromium, manganese, cobalt iron, nickel, metal oxidation, transition element

ABSTRACT: The presence of sulfur in the air frequently leads to acceleration of the oxidation rate, and sometimes to dangerous accidents. The present paper describes the results of investigating the oxidation of Ti, Cr, Mn, Co, Fe and Ni in air containing two chemically active components: oxygen and sulfur. For this group of metals the importance of sulfur in oxidation increases from titanium to nickel. This is explained by the fact that the sulfur activity rises and the oxygen activity drops. The percentage of sulfur in the oxidation scale increases from 0.004% for titanium to complete sulfuration of all the nickel under the layer of NiO. This explains the brittleness of nickel during heat treatment in sulfur-containing media. The process of metal oxidation in sulfur-oxygen media corrobo-

Card 1/2

ACCESSION NR: AT4013959

rates the previously published opinions of the authors. Orig. art. has: 2 figures and 2 tables.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy AN SSSR).

SUBMITTED: 00

DATE ACQ: 27Feb64

ENCL: 00

SUB CODE: MM

NO REF SOV: 011

OTHER: 002

Cord 2/2

ARKHAROV, V.I.

Remarks on A.S.Zav'ialov and B.I.Bruk's article "Redistribution
of components in solid solutions prior to decay." Fiz.met.i
metalloved. 15 no.4:626-628 Ap '63. (MIRA 16:6)

1. Institut fiziki metallov AN SSSR.
(Solutions, Solid) (Crystal lattices)

ARKHAROV, V.I.; KUZNETSOV, E.N.

Shape and size of the regions of coherent rearrangement of
crystal lattices during ordered allotropic transformations.
Fiz. met. i metalloved. 15 no.5:786-788 My '63. (MIRA 16:8)

1. Institut fiziki metallov AN SSSR.
(Crystal lattices) (Allotropy)

ARKHAROV, V.I.

Activating martensite transformations by preliminary sub-zero treatment of steel. Fiz. met. i metalloved. 15 no.6:929-932
Je '63. (MIRA 16:7)

1. Institut fiziki metallov AN SSSR.
(Steel---Metallography)
(Phase rule and equilibrium)
(metals, Effect of temperature on)

AGAPOVA, Ye.V.; ARKHAROV, V.I.; POLIKARPOVA, I.P.

Simultaneous effect of beryllium and antimony impurities on the aging
of copper-silver alloys. Fiz. met. i metalloved. 16 no.6:927-929 D '63.
(MIRA 17:2)

1. Institut fiziki metallov AN SSSR.

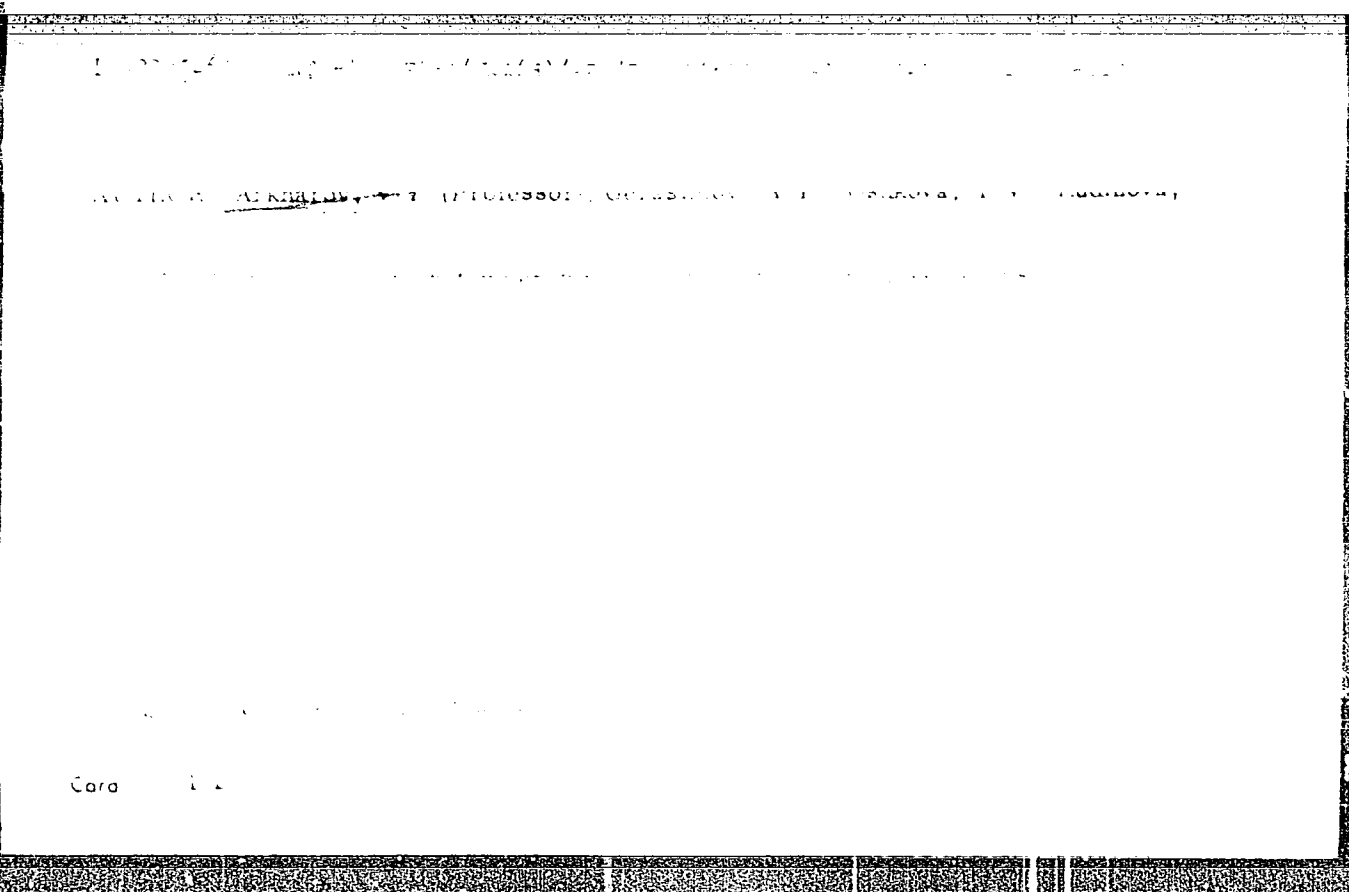
ARKHAROV, V.I.; BELENKOVA, M.M.; MIKHEYEVA, M.N.; MOISEYEV, A.I.;
POLIKARPOVA, I.P.

Change of magnetic susceptibility and the behavior of small impurities
in the decomposition of an Ag - Cu solid solution. Izv. AN SSSR.
Ser. fiz. 28 no.1:148-151 Ja '64. (MIRA 17:1)

1. Institut fiziki metallov AN SSSR.

ARKHAROV, V.I.

Submicrostructure of solids related to phase transformations.
Izv. AN SSSR. Ser. fiz. 28 no.1:152-156 Ja '64. (MIRA 17:1)



DATE 1977

ACCESSION NR A7209565

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Card 2/2